REMARKS

Claims 1-19 and 21-34 are pending in this application. By this Amendment, claim 20 is canceled, claims 5, 9, 10, 13-15, 17 and 19 are amended and new claims 27-34 are added. Attached hereto is a marked-up version of the changes to the claims by the current amendment. The attachment is captioned "Version With Markings To Show Changes Made".

The Office Action objects to claim 5 because of an informality. The above amendment to claim 5 obviates the ground for objection. Withdrawal of the objection is respectfully requested.

The Office Action rejects claims 1 and 3-7 under 35 U.S.C. § 102(b) by the article to Collins et al. entitled "Technique For Micro-Machining Millimeter-Wave Rectangular Waveguide" (hereafter Collins). The Office Action also rejects claims 2 and 8-26 under 35 U.S.C. § 103(a) over Collins in view of U.S. Patent 6,185,354 to Kronz. The rejections are respectfully traversed.

The present specification relates to a waveguide in a printed circuit board. More specifically, the background section describes the difficulty in electrically connecting components within a printed circuit board (PCB). Embodiments of the present invention may form metalized trenches/channels in printed circuit board (PCB) laminate materials or within cured multi-layer PCBs. Embodiments may also place/form a waveguide surface (i.e., a top wall of the waveguide) on bonding/adhesive material prior to laminating/bonding. The placement of the waveguide surface on the bonding material may be done by tack bonding, such as tack bonding a metal feature/strip to a b-stage side of a sheet of resin coated copper (RCC) foil, for example. The tack bonding process may be utilized to join b-stage

epoxy to other materials as one method to ensure alignment between circuit board layers. The bonding surface may have a metalized capping surface such that the metalized capping surface is located over the trench having the at least one metalized surface. See page 4, lines 7-22 of the present specification.

Figs. 5A-5B show the formation of a metalized capping surface that may be placed on a top of a trench 50. This may involve providing a substrate 20 which may be a bonding material such as an adhesive, epoxy, FEP, RCC or b-stage epoxy. A metal substrate 60 may be placed on one surface of the substrate 20. A metalized surface 37 may be placed on the bonding material and then the substrate 20, the substrate 60 and the metalized surface 37 may be placed on the waveguide structure of Fig. 4. Figs. 6A-6C illustrate another method of forming the metalized capping surface on bonding material. In this method, a metal coating 70 may be applied to one surface of the substrate 20. Portions of the metal coating 70 may be selectively removed so that only the metalized surface 37 remains. See page 7, line12-page 8, line 5 of the present specification.

Independent claim 1 recites forming a trench, providing at least one metalized surface along the trench and applying a bonding surface having a metalized capping surface to the substrate such that the metalized capping surface is located over the trench having the at least one metalized surface.

Collins discloses a procedure (in Fig. 1) in which troughs are developed, the sample is sputtered with gold to coat the inside walls, and a pre-sputtered lid is attached over the trough to complete the waveguide. Collins does not teach or suggest applying a bonding surface having a metalized capping surface to the substrate such that metalized capping surface is located over the trench having the

at least one metalized surface. Collins does not relate to a metalized capping surface as in the present application. Collins also does not disclose any type of bonding surface. Rather, Collins merely discloses attaching a pre-sputtered lid. This is not applying a bonding surface having a metalized capping surface.

As one example, Figs. 5B, 6C and 7 of the present application show a metalized surface 37 that may be aligned over metal traces 43 and 45 (provided on top of the substrate 10 just adjacent to the opening to the trench 50). See also page 8, lines 6-13 of the present specification. Collins does not suggest any type of similar metalized surface and/or bonding surface. In summary, Collins does not teach or suggest applying a bonding surface having a metalized capping surface as recited in independent claim 1. Thus, independent claim 1 defines patentable subject matter.

The Office Action agrees that Collins does not disclose the use of a printed circuit board substrate and a filled waveguide channel. The Office Action then relies on Kronz as teaching these missing features. Kronz describes the complexity and problems in using waveguides with printed circuit boards. See Kronz's background section and in particular Kronz's column 1, lines 45-47 and column 2, lines 1-12. Kronz describes a printed circuit board 44 having an integral waveguide 46. A solid dielectric layer 18 may have a first channel 36 and a second channel 38. A metallic plate 26 may overlay a land 34. The metallic layer 12 and the metallic plate 26 cooperate to form the waveguide 46. See column 2, lines 52-67.

There is no suggestion of how to combine Collins and Kronz as alleged in the Office Action. That is, the Office Action merely attempts to combine Kronz's integral waveguide in a printed circuit board with Collins' waveguide. However, Kronz is very

specific in the background section that there are difficulties in forming waveguides in printed circuit boards. As such, Kronz develops one technique of forming an integral waveguide within a printed circuit board. This concept cannot be modified without any suggestion in the art as Kronz is very specific regarding the problems in this field. Additionally, there is no suggestion how Collins' disclosure of developing troughs, sputtering a sample with gold, and attaching a pre-sputtered lid may be combined with Kronz. That is, Collins' technique of developing a trough, sputtering and attaching a lid cannot be simply provided within a printed circuit board. There is no suggestion for this modification, especially of the modification to Kronz's specific technique of forming an integral waveguide. Additionally, each of Kronz and Collins is directed to a separate methodology of how to form the respective waveguides. Each of these techniques is directed to a specific application (or environment). These methodologies may not simply be modified without taking into consideration the materials and environment. As one example, Collins appears to describe a photoresist capable of producing features in excess of 1 mm. See the paragraph above Fig. 1. Collins also appears to relate to wavelengths between 80 and 100 GHz. See Figs. 3 and 4. In stark contrast, Kronz appears to relate to a dielectric thickness of 25 to 200 microns and applicability to wavelengths in the neighborhood of 5 or 7 GHz. Clearly the size of Collins' structure is vastly different than the size of Kronz's structure. Additionally, Collins' structure is for use of a much different wavelength than Kronz's structure. This shows that Kronz's use of a waveguide in a printed circuit board may not be simply placed in Collins' waveguide as alleged. Collins' waveguide may not simply be modified to be formed into a printed circuit

board as alleged. Further, there is no suggestion that this type of modification is even possible.

The Office Action has clearly relied on impermissible hindsight to combine the two references as alleged. There is no suggestion in the prior art to modify the references as alleged. As stated in MPEP 706.02(j), the teaching or suggestion to make the claimed combination and the reasonable expectation of success must both be found in the prior art and not based on applicant's disclosure. The Office Action has not shown a proper suggestion to make this combination and/or a reasonable expectation of success. As such, the rejection of claims 2 and 8- 26 based on the combination of Collins and Kronz should be withdrawn at least for this reason.

Additionally, independent claim 9 recites forming a trench in a printed circuit board substrate, forming at least one surface and forming a top surface over the trench having the at least one surface where the top surface is different than the at least one surface. As discussed above, Collins does not relate to forming a trench in a printed circuit board. Additionally, Kronz (as well as Collins either alone or in combination) does not teach or suggest forming a top surface over the trench having the at least one surface where the top surface is different from the at least one surface (on the first side surface, the second side surface and the bottom surface of the trench). Accordingly, independent claim 9 defines patentable subject matter for at least this additional reason.

Independent claim 17 recites forming a trench in a printed circuit board and forming a waveguide structure in the trench of the printed circuit board by providing at least one metalized surface along the trench, and bonding a bonding surface having a metalized capping surface to the printed circuit board such that the

metalized capping surface is located over the trench having the at least one metalized surface so as to form the waveguide structure. As discussed above, Collins does not relate to forming a trench in a printed circuit board or to bonding a bonding surface having a metalized capping surface. Additionally, Kronz (as well as Collins either alone or in combination) does not teach or suggest bonding a bonding surface having a metalized capping surface to a printed circuit board such that the metalized capping surface is located over the trench having the at least one metalized surface so as to form the waveguide structure. Accordingly, independent claim 17 defines patentable subject matter for at least this additional reason.

Independent claim 22 recites a printed circuit board, bonding material provided on at least one surface of the printed circuit board and a waveguide structure provided within the printed circuit board. As discussed above, Collins does not relate to a printed circuit board or bonding material provided on at least one surface of the printed circuit board. Additionally, Kronz (as well as Collins either alone or in combination) does not teach or suggest the printed circuit board and bonding material. Accordingly, independent claim 22 defines patentable subject matter for at least this additional reason.

For at least the reasons set forth above, it is respectfully submitted that each of independent claims 1, 9, 17 and 22 defines patentable subject matter. Each of the dependent claims depends from at least one of the independent claims and therefore defines patentable subject matter at least for this reason. In addition, the dependent claims also recite features that further and independently distinguish over the applied references. For example, new dependent claim 28 recites that the bonding material comprises one of an epoxy and an adhesive. Each of dependent claims 30, 32 and

34 recites that the bonding surface includes a bonding material comprising one of an epoxy and an adhesive. Collins merely describes a pre-sputtered lid. There is no suggestion for epoxy or adhesive. The cited references do not teach or suggest the type of bonding material or bonding surface as recited in dependent claims 28, 30, 32 and 34. As such, dependent claims 28, 30, 32 and 34 define patentable subject matter at least for this additional reason.

Dependent claim 27 recites that the metalized capping surface is substantially aligned only over the trench. Each of dependent claims 29, 31 and 33 include similar features. The cited references do not teach or suggest these features as they do not relate to aligning a metalized capping surface over a trench. That is, Collins merely describes attaching a pre-sputtered lid. As such, dependent claims 27, 29, 31 and 33 define patentable subject matter at least for this additional reason.

Additionally, dependent claim 6 recites that the metalized capping surface on the bonding surface is formed by applying a metal coating on the bonding surface and selectively removing portions of the metal coating such that the metalized capping surface remains on the bonding surface. Additionally, dependent claim 7 recites that the metalized capping surface on the bonding surface is formed by providing the bonding surface and selectively placing the metalized capping surface on the bonding surface. Each claims 13-15 includes similar features (and recite a separate top metalized surface). The cited references do not teach or suggest these features relating to forming the metalized capping surface (or the separate top metalized surface). The Office Action does not even mention these features. The Office Action therefore fails to make a prima facie case of obviousness at least with

respect to these features. Claims 6, 7 and 13-15 define patentable subject matter at least for these additional reasons.

For at least the reasons set forth above, it is respectfully submitted that each of claims 1-19 and 21-34 define patentable subject matter. Withdrawal of the outstanding rejections is respectfully requested.

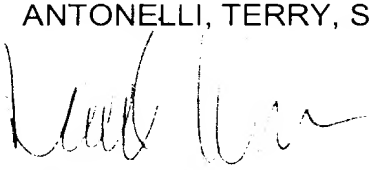
CONCLUSION

In view of the foregoing, it is respectfully submitted that the above-identified application is in condition for allowance. Favorable consideration and prompt allowance of claims 1-19 and 21-34 are respectfully requested.

Please charge any shortage in fees due in connection with the filing of this paper, including extension of time fees, to Deposit Account No. 01-2135 (219.40432X00) and please credit any excess fees to such Deposit Account.

Respectfully submitted,

ANTONELLI, TERRY, STOUT & KRAUS, LLP



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VERSION WITH MARKINGS TO SHOW CHANGES MADE

IN THE CLAIMS:

Claims 5, 9, 10, 13-15, 17 and 19 have been amended as follows:

5. (Amended) The method of claim 1, wherein said at least one metalized surface comprises sidewall surfaces and a bottom surface of ~~said~~ a waveguide structure.

9. (Amended) A method comprising:

forming a trench in a printed circuit board substrate, said trench having a first side surface, a second side surface and a bottom surface;

forming at least one surface on said first side surface, said second side surface and said bottom surface of said trench; and

forming a top surface over said trench having said at least one surface, said top surface being different than said at least one surface.

10. (Amended) The method of claim 9, wherein said at least one surface comprises at least one metalized surface and said top surface comprises a separate top metalized surface.

13. (Amended) The method of claim 11, wherein forming said separate top metalized surface over said trench comprises affixing a bonding surface having a metalized capping surface to said printed circuit board substrate.

14. (Amended) The method of claim 13, wherein said separate top metalized surface on said bonding surface is formed by applying a metal coating on said bonding surface and selectively removing portions of said metal coating such that said separate top metalized surface remains on said bonding surface.

15. (Amended) The method of claim 13, wherein said separate top metalized surface on said bonding surface is formed by providing said bonding surface and selectively aligning said top metalized surface on said bonding surface.

17. (Amended) A method comprising:

forming a trench in a printed circuit board; and

forming a waveguide structure in said trench of said printed circuit board~~, said waveguide structure having at lest one metalized surface,~~ by providing at least one metalized surface along said trench, and bonding a bonding surface having a metalized capping surface to said printed circuit board such that said metalized capping surface is located over said trench having said at least one metalized surface so as to form said waveguide structure.

19. (Amended) The method of claim 18, wherein said waveguide structure comprises said at least one metalized surface on said first sidewall, said second sidewall and said bottom wall and ~~a~~ said metalized capping surface on a top of said trench.